

SYNOPSIS

Review of “Prevalence of vaping and smoking among adolescents in Canada, England, and the United States: repeat national cross sectional surveys”

Prepared by: N. Bruce Baskerville

Reviewed by: Kara Watson, Brent Moloughney, Heather Manson

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Contact information: bruce.baskerville@oahpp.ca

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Key Messages

- Relatively little evidence exists on the impact of different regulatory approaches on vaping prevalence among young people. Hammond et al.’s study examining differences in vaping and smoking prevalence among adolescents in Canada, England, and the United States contributes to filling this gap.
- Between 2017 and 2018, among 16 to 19 year olds, the prevalence of vaping increased in Canada and the US, as did smoking in Canada, with little change in England. This is consistent with the authors’ hypothesis that Canada would experience greater increases in vaping due to the combination of regulatory change and the introduction of e-cigarettes containing nicotine salts into the market.
- The use of Juul (a nicotine salt based electronic cigarette with high nicotine concentration) increased in all countries, particularly the US and Canada—for example, the proportion of current vapers in the US citing Juul as their usual brand increased threefold between 2017 and 2018.
- This repeated cross-sectional study is well executed with a large sample to examine differences in vaping and smoking prevalence among adolescents in Canada, England, and the United States over time, and a clear description of sampling methods, outcome measures and covariates. Study limitations include a limited number of covariates in the analysis, not addressing missing data and reliance on commercial web-panel surveys that may not be representative of the intended target population.

Background

The authors compared changes between 2017 and 2018 in the prevalence of vaping and cigarette smoking among 16 to 19 year olds in Canada, England and the US.¹ In May 2018, Canada implemented new vaping policies with the enactment of the *Tobacco and Vaping Products Act* (TVPA) that regulates the manufacture, sale, labelling and promotion of tobacco and vaping products sold in Canada.² The act permits the sale of e-cigarettes containing nicotine and greater advertising and promotion of vaping products. Nicotine salt-based products such as Juul (JUUL CA) were launched in Canada in September 2018.³ Juul is an e-cigarette device designed to be rechargeable at a USB port with flavour ‘pods’ that include mint, mango and fruit. Each flavour pod contains the nicotine equivalent of a pack of cigarettes.⁴ Juul delivers higher concentrations of nicotine to the brain than most conventional e-cigarettes due to its proprietary technology and the use of nicotine salts.^{5,6} There is little evidence on the impact of different regulatory approaches and the availability of nicotine-salt based products on vaping prevalence among young people.⁷ The authors’ hypothesis was that Canada would experience greater increases in vaping due to the combination of regulatory change and the introduction of e-cigarettes containing nicotine salts into the market.

Appraisal

Study Design

This repeated cross sectional study used data from online surveys of commercial panels recruited from the International Tobacco Control Policy Evaluation Project - Youth Tobacco and Vaping Survey conducted in Canada, England and the US. The first wave (wave 1) was conducted from July to August 2017 and the second wave (wave 2) was conducted from August to September 2018. Eligible respondents included adolescents aged 16 to 19 years of age at the time of recruitment. Respondents were asked if they had ever tried an e-cigarette/vaped, the number of days they had used an e-cigarette/vaped in their lifetime and the last time they had used an e-cigarette/vaped (analysed as ever, past 30-day and past week vaping). Parallel questions were asked about cigarette smoking. The use of Juul and other vaping brands was also assessed.

The same methods of recruitment were used in all three countries. Respondents were recruited from the Nielsen Consumer Insights Global Panel, which maintains commercial panels in Canada, England and the US. The Nielsen panel uses both probability and non-probability sampling methods in each country. A total of 13,468 participants completed wave 1 and 13,423 completed wave 2 online surveys. A total of 1,340 were excluded at wave 1 and 1,623 were excluded at wave 2 based on data integrity checks and incomplete data for calculating sample weights and determining smoking or vaping status. The final sample that was analysed included a total of 12,128 participants recruited at wave 1 and 11,800 participants that were recruited at wave 2. Analysis included logistic regression models adjusting for age, sex and race/ethnicity. Respondents with missing data on outcomes or covariates were excluded from the models. Differences between countries were assessed by testing the two way interaction between country and wave.

[Appendix A](#) provides a quality assessment of the study using the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.

Main Findings

- Overall, this study found that the prevalence of vaping increased significantly in Canada and the US between 2017 and 2018 ($P < .001$ for all), with no changes in England. Smoking prevalence increased in Canada ($P < .001$ for all), with modest increases in England, and no changes in the US.
- Among 16 to 19 year olds, past 30-day vaping increased by 73.8% in Canada from a prevalence of 8.4% in 2017 to 14.6% in 2018 (AOR = 1.95, 99% CI = 1.58-2.40). In the US, there was a 44% increase in the prevalence of past 30-day vaping (AOR = 1.55, 99% CI=1.28-1.88) and no change in prevalence in England over the same time period. The prevalence of vaping in the past week and on 15 days or more in the past month also increased significantly in Canada and the US between 2017 and 2018, with no changes in England.
- The percentage of ever vapers who reported more frequent vaping increased in Canada and the US, but not in England. For example, past 30-day vaping in Canada amongst ever vapers went from 28.8% in 2017 to 39.5% in 2018 (AOR=1.69, 99% CI 1.33-2.16).
- Among never smokers and experimental smokers, the prevalence of vaping in the past 30 days, in the past week and on 15 days or more in the past month significantly increased in Canada and the US between 2017 and 2018, with no changes in England. For example, past 30-day vaping in Canada among never smokers went from 2.3% in 2017 to 5% in 2018 (AOR=2.35, 99% CI 1.51-3.65) and for experimental smokers (smoked fewer than 100 cigarettes in lifetime) it went from 18.2% to 28.7% (AOR=1.85, 99% CI 1.37-2.50).
- In the US, the proportion of past 30-day vapers who reported Juul as their usual brand increased from 9.4% in 2017 to 28.1% in 2018 (AOR = 3.79, 99% CI 2.28-6.31). In 2017, no one who vaped in the past 30 days in Canada or England reported Juul as their usual brand; in 2018, this increased to 10.3% of past 30-day vapers in Canada and 3.3% in England.
- Among 16 to 19 year olds, past 30-day smoking increased in Canada from an estimated prevalence of 10.7% in 2017 to 15.5% in 2018 (AOR = 1.60, 99% CI = 1.32-1.94). Similarly, past 30-day smoking in Canada among ever cigarette smokers went from 33.4% in 2017 to 42.4% in 2018 (AOR = 1.46, 99% CI 1.16- 1.83).
- The prevalence of smoking in the past week and on 15 days or more in the past month also significantly increased in Canada; however, there were no significant changes in the US on any of the smoking prevalence measures. England did show a significant, but small, increase in the prevalence of smoking in the past week and on 15 days or more in the past month, with no change in smoking in the past 30 days.
- Given their results, Hammond et al., propose consideration of regulatory measures that more selectively target vaping products to adult smokers. They further note that the few differences between wave 1 and wave 2 for England may be the consequence of mandatory limits on nicotine concentration of e-liquids (20 mg/ml, whereas the standard version of Juul in North America has over 50 mg/ml) and greater restrictions on marketing.¹ However, authors caution that additional research is required before population level changes in vaping can be attributed to specific regulatory and market factors.

Strengths

- The Hammond et al. study is one of the first studies to document the impacts of regulatory changes in Canada and the introduction and rapid emergence of nicotine salt-based vaping products in Canada and the US, notably the significant increase in vaping from 2017 to 2018 among adolescents in the US and Canada.
- Further, the study documents a significant increase in smoking among Canadian adolescents in 2018, which is in contrast to the steady decline in the prevalence of smoking among adolescents from 2007 to 2017.⁸ Fewer changes were observed among adolescents in England, possibly as a result of greater marketing restrictions and maximum nicotine limits (20mg/ml) under the European Tobacco Product Directive.
- The study offers a large sample to detect an effect by jurisdiction, with a clear description of sampling methods, sample weighting, outcome measures and covariates. The same sampling methods were used across all three jurisdictions.
- As a natural experiment, the study provides a unique perspective through the comparison of three different regulatory environments at two points in time on adolescent e-cigarette use and smoking and supports the need for future research on the attribution of regulations and market changes to the prevalence of vaping.

Limitations

Due to the repeated cross-sectional nature of the study design, one cannot infer causation from the associations identified in the study. In addition, the study controlled for a very limited number of determinants or covariates (age, sex and ethnicity). There is the possibility that some other factors, such as sensation seeking or risk taking behaviour, may have influenced the outcome measures. The authors examined this possibility by independently assessing alcohol and cannabis use as proxies for risk taking behaviour; however, these variables were not included in the main analysis and missing or incomplete data were not accounted for in their assessments.

The prevalence estimates for smoking and vaping from the study are derived from non-probability web-based panel surveys. The key disadvantages of web panel surveys are the problems of self-selection and under-coverage.⁹ Web-panel surveys maintained by organizations, such as Nielsen, use incentive schemes to ensure ongoing survey participation with the potential of creating professional survey takers that may not represent the intended target population. In addition, online panels do not represent youth who do not regularly go online, resulting in the problem of under-coverage of the population. Further, the authors reported that parents were asked for permission for their son or daughter to complete the survey, potentially further limiting representativeness. To assess representativeness and generalizability, the authors drew comparisons between the estimates derived from the panel surveys and national probability-based sample surveys in Canada and the US. The authors determined a high level of consistency with national benchmarks in the US and Canada. In contrast, no nationally representative probability based survey of adolescents exists in England. The findings of this study need to be confirmed with future studies using probability-based survey samples over the same time period.

Reliability

The authors of this study report funding for the project from a US National Institutes of Health grant. Several of the authors have also served as paid expert witnesses in legal challenges against tobacco

companies. No other conflicts of interest are reported. The results of this article are published in a high impact journal (BMJ Impact factor = 23.295 in 2017) that is recognized as one of the top general medical journals in the world, with a fully open peer review process. The authors are public health researchers and the lead author's area of research focuses on population-level interventions to reduce chronic disease, primarily in the areas of tobacco control.

Relevancy

This study is one of the first to assess the relationship between the implementation of recent Canadian vaping legislation permitting the sale of e-cigarettes containing nicotine, and vaping and smoking among adolescents in Canada. The prevalence of vaping among Canadian adolescents increased between 2017 and 2018, along with increases in smoking. The study findings suggest that vaping among youth might be changing in North America markets, in parallel with the rapid emergence of nicotine salt-based vaping products. Fewer changes were observed in England, possibly as a result of greater marketing restrictions and maximum nicotine limits.

Ontario Applicability

The study was based on Canadian data, including study participants who resided in Ontario.

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Appendix A

Quality assessment tool sourced from: NIH National Heart Lung and Blood Institute. Study quality assessment tools: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies [Internet]. Bethesda, MD: National Heart Lung and Blood Institute; 2018 [cited 2018 Oct 18]. Available from: www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools.

Hammond et. al. (2019) – Responses to criteria		Yes	No
1.	Was the research question or objective in this paper clearly stated?	X	
2.	Was the study population clearly specified and defined?	X	
3.	Was the participation rate of eligible persons at least 50%?	X	
4.	Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?	X	
5.	Was a sample size justification, power description or variance and effect estimates provided?	X	
6.	For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?		X
7.	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?		X
8.	For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure or exposure measured as continuous variable)?	NA	
9.	Were the exposure measures (independent variables) clearly defined, valid, reliable and implemented consistently across all study participants?	X	
10.	Was the exposure(s) assessed more than once over time?	NA	
11.	Were the outcome measures (dependent variables) clearly defined, valid, reliable and implemented consistently across all study participants?	X	
12.	Were the outcome assessors blinded to the exposure status of participants?	NA	
13.	Was loss to follow-up after baseline 20% or less?	X	
14.	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?		X

Authors

N. Bruce Baskerville, Applied Public Health Science Specialist, Health Promotion, Chronic Disease and Injury Prevention, Public Health Ontario

Contributors

Kara Watson, Senior Product Development Advisor, Health Promotion, Chronic Disease and Injury Prevention, Public Health Ontario

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